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Pakistan's Climate Policy and Governance: Challenges, Progress and Pathways for Low-Carbon Future

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ABSTRACT

Pakistan is among the list of most vulnerable countries to climate change. As its economy, society, and environment face severe risks from floods, droughts, and rising temperatures, with the 2022 floods displacing 33 million people and causing damages of 14.9 billion dollars, showing the scale of exposure to climate risks. This study reviews national policies on adaptation and mitigation, their alignment with global agreements, and the barriers that limit progress in sectors such as agriculture, water, health, infrastructure, energy, industry, transport, and forestry. Pakistan has introduced key frameworks such as the National Climate Change Adaptation Policy 2021 and the Nationally Determined Contribution 2021, while progress is visible in renewable energy projects, tree plantation drives, and community based adaptation efforts. Despite these steps, challenges remain as climate finance is less than 0.5 percent of GDP compared to the actual need of 2-3 percent. Furthermore, the responsibilities are divided among 17 institutions leading to weak coordination and time lapses. On the other hand provincial governments also lack technical capacity, monitoring systems, it track only 30 percent of projects, and access to international finance and technology is restricted. The study recommends stronger institutions, higher climate investment, better monitoring, wider community participation, regional cooperation, and private sector engagement, arguing that with reforms and global support Pakistan can build a resilient and low-carbon future.

Introduction

Climate change is the most pressing challenge of the 21st century (Dalal, 2025). It not only destroying ecosystems and reducing natural resources but also cause billions to the economies especially, the developing economies. Beside this human lives are being lost in heatwaves, floods, and storms. Pakistan is among the nations that are most severely affected by these natural disasters (Aslam et al., 2020). The Global Climate Risk Index 2021 placed Pakistan on 8th position among the most affected countries from 2000 to 2019 which confirms the scale of the threat that country facing. The country faces strong heatwaves and rapid glacial melting, unpredictable monsoons and recurring floods which damage farms, homes, and cities every year.

In recent decades, climate disasters in Pakistan have become more frequent and more severe (Hussain et al., 2020). The floods of 2010 covered almost one-fifth of the country. They affected 20 million people and caused losses of more than \$10 billion. Another disaster came in 2022 when massive floods struck again and more than 33 million people were affected. The catastrophic events take off over 1,700 people, and damages were estimated at \$14.9 billion. These events show the rising human and economic costs of climate change. Climate change is also harming Pakistan through slow and long term impacts. Rising temperatures have caused dangerous heatwaves. The heatwave of 2015 killed more than 1,200 people in Karachi and overwhelmed hospitals. Water shortages have also become very serious. Around 80% of the population faces extreme water scarcity for at least one month each year. This puts farming at risk, and farming employs about 38.5% of the country's workers. Water stress also increases food shortages and nutritional problems (Tinazzi, 2024).

Given these situation, Pakistan's climate change policy framework assumes vital importance in guiding the nation's response to this existential threat. This paper undertakes on an in-depth exploration of Pakistan's climate change policies, aiming to analyse their key components, assess their implementation mechanisms, and evaluate their impact on various sectors of the economy and society. Moreover, the paper examine into the complex institutional arrangements underpinning the execution of these policies, scrutinizing the roles and responsibilities of governmental bodies, non-governmental organizations, and other stakeholders in driving climate action forward.

Furthermore, the paper endeavours to contextualize Pakistan's climate change efforts by comparing them with the standards set by the United Nations and the policies adopted by other developing countries facing the similar challenges. By undertaking such a comparative analysis, we seek to extract insights into Pakistan's relative progress, identify areas of convergence and divergence, and summarize lessons learned from global experiences to inform future policy formulation and implementation.

In essence, this paper intends to provide a comprehensive overview of Pakistan's climate change policy landscape, describing its framework, probing its efficacy, and explaining the challenges and opportunities that lie ahead. By unveiling on these critical dimensions, we aim to contribute to a deeper understanding of Pakistan's climate change trajectory and foster informed dialogue and action towards building a more resilient and sustainable future in the face of climate uncertainty.

Literature Review

Climate change lead to a significant threat to Pakistan Environment, Economy and Society. It increases the vulnerabilities and challenged development efforts. The literature regarding climate change provides valuable insight into multifaceted challenges and policy responses in Pakistan.

The impacts of climate change in Pakistan is quite evident in increasing number of extreme weather events like floods, drought, and heatwaves. In 2020, devastating floods approximately affected the 20 million people and caused financial loss \$10 billion (Rehmat et al., 2023). In addition to that heatwave of 2015 caused over 1200 fatalities and overwhelmed healthcare facilities across the country, highlighted the importance of addressing the climate-related health risk (Akhtar, 2016)

Agriculture sector consider as backbone of Pakistan's economy and provides livelihood to millions is quite vulnerable to impacts of climate change. Heavy rainfall, temperature up and downs and pest infestations have been identified as major challenges i.e affecting the crops, food insecurity and rural livelihoods (Usman et al., 2025). These challenges further exacerbated by water scarcity and soil degradation, increasing the importance of adaptive strategies and resilient farming to ensure food security and livelihood sustainability (Srivastav et al., 2021)

In response to these challenges, Pakistan has formulated a series of climate change policies and strategies aimed at addressing adaptation, mitigation, and resilience-building. The National Climate Change Policy (NCCP) of 2012 serves as a cornerstone of Pakistan's climate change governance framework, outlining objectives, priorities, and action plans across various sectors (Government of Pakistan, 2012). However, challenges related to policy implementation, institutional coordination, and resource allocation hinder the effective execution of these policies.

Furthermore, Pakistan's efforts to align its climate change policies with international standards and commitments present additional complexities. Engagement with international climate negotiations, such as those under the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement, offers opportunities for accessing climate finance, technology transfer, and capacity-building (Khan et al., 2016).

Beyond sector-specific challenges, Pakistan faces transboundary issues related to climate change, particularly in water management and shared river basins. The Indus River, vital for irrigation and hydropower generation, is subject to upstream interventions and changing hydrological patterns due to climate variability, posing challenges for water security and regional stability (Das & Bhutta, 2025)

Additionally, the phenomenon of urbanization has further compounded the challenges of climate change in Pakistan. Rapid urban growth, inadequate infrastructure, and unplanned development exacerbate vulnerability to climate-related hazards such as urban flooding, heat islands, and air pollution (Abdul & Yu, 2020). Studies by (Hyder et al., 2024) and (Iqbal & Ullah, 2024) underscore the need for integrated urban planning and climate-resilient infrastructure to address these challenges and promote sustainable urban development.

Moreover, the role of renewable energy in mitigating climate change impacts and reducing dependence on fossil fuels has garnered increased attention in Pakistan. Research by (Hassan et al., 2021) and (Bhandari et al., 2024) examines the potential of solar, wind, and hydropower technologies in diversifying Pakistan's energy mix, enhancing energy security, and reducing greenhouse gas emissions. However, challenges such as financing constraints, regulatory barriers,

and technical limitations hinder the widespread adoption of renewable energy solutions (Mirza et al., 2009).

In conclusion, the literature underscores the urgency of addressing climate change in Pakistan through integrated policy interventions, enhanced institutional capacities, and multi-stakeholder collaboration. By synthesizing these insights, policymakers can develop more effective climate change policies and strategies that promote sustainable development and resilience-building in Pakistan and beyond.

Methodological framework

This study uses a structured framework to review Pakistan's climate policies. It applies qualitative content analysis to official policy documents, government reports, and international assessments. The review includes adaptation policies and mitigation policies. It looks closely at the goals of each policy. It also examines the ways chosen for implementation. It further checks the progress that has been made so far. A policy analysis matrix is used for this purpose. This tool helps compare policies across major sectors. These sectors of the economy include energy, agriculture, water, health, forestry, and infrastructure. The study follows four criteria to check the strength of the policies. The first criterion is effectiveness. This shows if a policy can achieve its stated goals. Examples include emission reduction, renewable energy growth, and adaptation targets. The second criterion is efficiency. This looks at the cost of a policy and the benefits it creates. It also considers the use of finance and technical resources. The third criterion is equity. This checks if policies deal fairly with regions, gender roles, and vulnerable groups. The last criterion is feasibility. This checks if institutions are strong enough. It also looks at policy continuity and technology readiness. The framework gives a clear way to judge climate governance in Pakistan. It also highlights the main gaps. Finally, it allows comparison with international best practices.

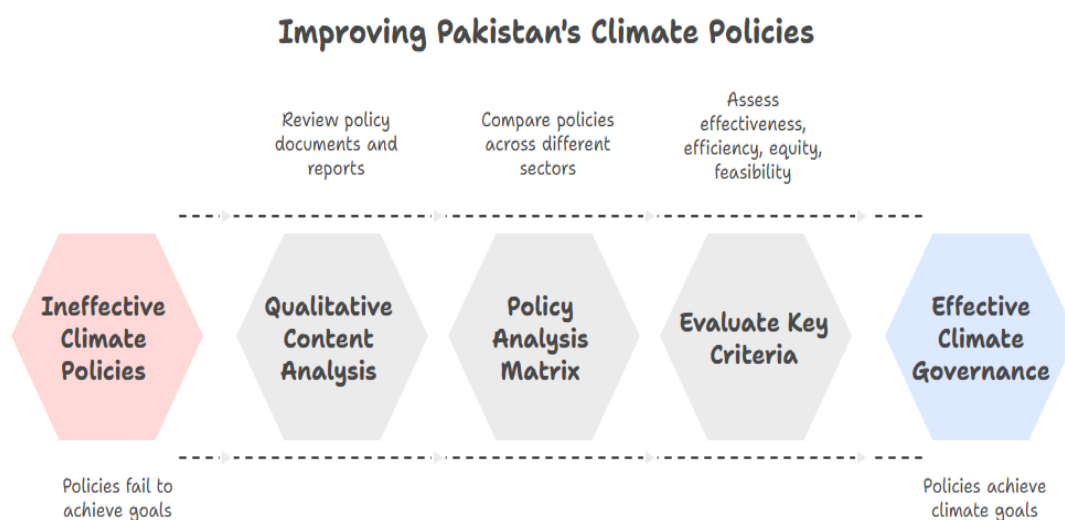


Figure 1: Methodological framework

Historical Evolution of Climate Change Policy

Pakistan started responding to climate change in the late 20th century and during this period, global concern for the environment was growing. The country joined international platforms to show its commitment. In 1992, Pakistan signed the United Nations Framework Convention on

Climate Change at the Rio Earth Summit. Besides this progress at home was very slow and early steps only focused on awareness campaigns. These efforts did not include clear actions or proper plans. In the early 2000s, disasters became frequent and severe and this forced the government to start formal climate policies. The National Environmental Action Plan of 2001 was an early step. It had no clear climate goals. It also lacked a system for proper implementation.

In the early 2000s, Pakistan changed its approach as climate impacts became visible clearly. A long drought from 1998 to 2002 harmed more than 3 million people in Balochistan and Sindh and extreme heatwaves and irregular monsoon rains also damaged farming and reduced water supplies. In 2001, the government introduced the National Environmental Action Plan (NEAP) which mentioned climate change as a concern but, it did not set clear goals for reducing emissions or adapting to risks. It also lacked enough funding and strong enforcement systems (Government of Pakistan, 2001).

A major shift came after the 2010 floods. These floods covered almost one-fifth of the country's land. Around 20 million people were affected and cause damage of cost more than \$10 billion. The disaster showed Pakistan's deep risk to climate change. In 2012, the state created the Ministry of Climate Change (MoCC). This new body was made to lead and coordinate climate action. In the same year, Pakistan approved its first National Climate Change Policy (NCCP). The policy gave a clear framework for both adaptation and mitigation (World Bank, 2011).

The NCCP of 2012 set out 120 policy actions in water, agriculture, energy, and forestry. It focused on disaster preparedness, water saving, and climate resilient infrastructure. After this policy, the government prepared more detailed plans, these included the National Climate Change Adaptation Policy (NCCAP) and the National Climate Change Mitigation Policy (NCCMP). Both gave specific guidance and measurable goals. These goals included raising forest cover to 6% of the land and producing 60% of energy from renewable sources by 2030 (MoCC, 2012).

In 2016, Pakistan showed its commitment to global climate action by ratifying the Paris Agreement, further, country also submitted its Nationally Determined Contribution (NDC) and in this pledge, Pakistan promised to cut 50% of its projected greenhouse gas emissions by 2030. Out of this set target 15% was unconditional and other 35% depended on support from the international community. The pledge was supported by the National Action Plan on SDGs and this plan placed climate goals within the wider framework of sustainable development (UNFCCC, 2016).

Implementation challenges became a constant barrier to progress. A review in 2018 showed that only 40% of the actions in the NCCP were partly or fully carried out. Weak coordination was a major problem. At least 17 federal agencies were working on climate issues without proper alignment. Lack of funds also reduced impact. Climate spending was less than 1% of the national budget between 2016 and 2020 (Climate Change Performance Index, 2018).

Recent years show a stronger focus on implementation. The Ten Billion Tree Tsunami Program (TBTTP) was launched in 2018, it was one of the largest tree planting projects in the world. In 2020, the government decided to introduce the National Electric Vehicle Policy, the main goal is to shift 30% of vehicles to electricity by 2030. The Climate Change Act of 2021 also established the Pakistan Climate Change Council and the Pakistan Climate Change Authority. The aim to set these new bodies provide stronger institutions for future action (Government of Pakistan, 2021).

Despite recent progress, Pakistan's climate policy is still more reactive than proactive. Most policies have emerged after major disasters. Long-term planning has been limited. The country still struggles with weak financing, poor coordination, and low technical capacity. Yet, climate issues

are now more visible in national development plans. This shows a growing awareness that climate change is a serious threat to Pakistan's sustainable development (Asian Development Bank, 2022).

Policy Framework and Institutional Mechanisms

Pakistan's climate policy framework is based on the National Climate Change Policy (NCCP) of 2012, established after the 2010 catastrophic floods which displaced 20 million people and caused more than \$10 billion in losses. The NCCP sets a broad plan for adaptation, mitigation, and resilience in key sectors of the economy with the goals include improving water security through better management. They also include promoting climate-smart farming to protect food supplies. Another goal is shifting to low-carbon energy to cut emissions. A major part of the policy is Pakistan's Nationally Determined Contribution (NDC), in this pledge, Pakistan aims to reduce 50% of its projected greenhouse gas emissions by 2030. This target depends on international finance and technical support (Ministry of Climate Change, 2012; World Bank, 2011).

The institutional framework for climate governance in Pakistan is decentralized but loosely coordinated. The Ministry of Climate Change (MoCC) was created in 2012. It is the main federal body for policy coordination. It manages international negotiations and oversees national climate programs. Its role includes aligning sectoral policies with national climate goals and helps in inter-ministerial collaboration. At the provincial level, all four provinces have their own climate policies like Punjab introduced its Climate Change Policy in 2017 and Sindh introduced its Climate Change Policy in 2018. These policies adjust federal goals to local conditions. Punjab's policy gives more focus to agriculture because Punjab provides 68% of the country's food grains. Sindh's policy gives more focus to coastal resilience due to the risk floods from sea-level rise (Government of Punjab, 2017; Government of Sindh, 2018).

Financial mechanisms are an important part of Pakistan's climate framework. The Climate Change Fund was created in 2019 with an initial allocation of PKR 80 million, which is about \$500,000. The fund is meant to support adaptation and mitigation projects at national and provincial levels. Pakistan has also received finance from international sources. One example is a \$188 million grant from the Green Climate Fund. This grant supports the "Recharge Pakistan" project which focuses on ecosystem-based adaptation and water management. Despite these inflows, climate spending is still very low, it was less than 1% of the total national budget in the 2022–23 fiscal year. This gap in funding makes it hard to carry out large projects. It also limits the expansion of pilot initiatives (Ministry of Finance, 2023; Green Climate Fund, 2022).

A major barrier to effective climate governance is institutional fragmentation. Overlapping mandates create problems. More than 17 federal ministries and agencies have climate-related roles, weaken coordination and reduce efficiency. Water resource management is one example. It involves the Ministry of Water Resources, the Ministry of Climate Change, provincial irrigation departments, and the Pakistan Council of Research in Water Resources. Their roles often overlap leads to repeated work and conflicting priorities. An audit report in 2021 showed that only 40% of federal climate projects from 2016 to 2020 were completed on time, this is mainly due to unnecessary delays and unclear responsibilities (Auditor General of Pakistan, 2021).

Capacity gaps at the provincial and local levels make these problems worse. Provincial climate change units have been created. They often lack technical skills, financial independence, and institutional power. This limits their ability to design and manage complex projects. The problem is more visible in Balochistan and Khyber Pakhtunkhwa, these provinces face shortages of skilled staff and weak infrastructure and these gaps slow the implementation of climate policies. In

Balochistan, the climate cell works with very few staff and depends on federal support for planning and implementation. This slows responses to climate emergencies such as droughts and flash floods. Efforts to build capacity are underfunded and irregular, prevents long-term improvements in governance (Planning Commission, 2022).

Non-state actors play an important role in supporting government efforts. These are civil society groups, research institutes, and international partners. WWF-Pakistan and the International Centre for Integrated Mountain Development (ICIMOD) are key examples. They have carried out community-based adaptation programs. These programs have supported more than 500,000 people with main focus has been on sustainable farming and water conservation. The Global Change Impact Studies Centre (GCISC) provides climate models, risk studies, and policy advice. This work supports national planning, reduce capacity gaps and promote innovation. However, their impact is limited, most projects still rely on short-term funding. (WWF-Pakistan, 2022; GCISC, 2021).

International partnerships are a key part of Pakistan's climate strategy. The country takes part in global climate forums. These include the COP meetings under the UNFCCC. Pakistan has also ratified the Paris Agreement and the Kyoto Protocol. It works with development banks to gain support. The World Bank and the Asian Development Bank are major partners. Through these ties, Pakistan has received funds for renewable energy projects. It has also secured support for disaster risk reduction and resilience programs. One example is the World Bank's \$500 million National Hydrology Project. This project improves water management with better monitoring systems and new infrastructure. These partnerships provide money, provide technical skills and technology transfer which improves national capacity (World Bank, 2022; UNFCCC, 2016).

Looking ahead, Pakistan needs strong reforms and better coordination to improve and enhance climate governance. The 2021 Climate Change Act proposed the creation of the Pakistan Climate Change Authority, the body would bring planning, implementation, and monitoring under one system. It would also manage the implementation of NDCs and oversee climate finance. It would ensure that policies remain consistent across sectors and regions. More resources and authority should also be given to provinces and local governments. This will help them deal with region-specific climate risks. It must be recognized that with stronger governance, higher domestic financing, and continued global support fighting against the climate threats will be effective and these steps can help Pakistan to turn its climate policies into real resilience for its vulnerable people (Climate Change Act, 2021; Ministry of Climate Change, 2021).

Effectiveness and Implementation Challenges

The success of Pakistan's climate policies has been uneven across sectors and regions. There are clear gaps between policy goals and action on the ground. Though, the awareness of climate change has grown among both policymakers and the public but still real outcomes are still limited. The energy sector shows this gap, renewable energy makes up only 4% of total power generation against the set target is 30% by 2030. Forest loss also continues as deforestation rate is between 0.2% and 0.5% each year. This happens despite large programs such as the Ten Billion Tree Tsunami Programme (World Bank, 2023; Ministry of Energy, 2022).

Financial limits are the biggest barrier to effective climate action in Pakistan. The country spends less than 1% of its national budget on climate activities each year. This is far below the estimated need of \$7–14 billion per year to achieve its NDC targets. The Climate Change Fund was created in 2019. It began with only PKR 80 million, which is about \$500,000, and this fund remains

severely underfinanced or used for administrative expenses. External sources cover more than 80% of climate spending. Many projects stop when this external funding ends (Ministry of Finance, 2023; UNDP, 2022).

Weak institutional capacity continues to slow implementation. At the federal level, only 30% of climate staff have specialized training in climate planning or project management. At the provincial level, the share is only 15%. Frequent changes in key posts also disrupt progress. The average tenure at higher level administrative posts is 2–3 years, these frequent and unnecessary changes reduces policy continuity and weakens institutional memory. Overlapping mandates among 17 federal agencies add further to the problem. These overlaps create coordination gaps and lead to wasted resources. An audit in 2022 reported that 40% of climate funds were used for administrative purposes. Only the remaining share went to field projects (Auditor General of Pakistan, 2022).

Regulatory gaps and policy inconsistencies remain major barriers. The National Environmental Quality Standards of 1997 are still applied, these have not been updated to reflect present climate needs. Sectoral policies also create conflicts that weaken climate goals. Energy subsidies for fossil fuels instead of renewables are a clear example. The lack of a unified monitoring system worsen the situation. Only 20% of climate projects are reviewed with strict impact evaluations. This gap makes it difficult to measure effectiveness and ensure accountability (Pakistan Environmental Protection Agency, 2021).

Political instability has reduced progress on climate action. Governments change every 2–3 years on average. Each change brings policy shifts and reversals. The Clean Green Pakistan Initiative of 2018 lost priority after the new administration in 2022. This situation discourages long-term investment. A clear example is the cancellation of \$3 billion in planned renewable energy projects. The cancellations occurred because of policy uncertainty between 2018 and 2023 (State Bank of Pakistan, 2023).

Provincial differences in capacity increase regional inequalities. Punjab has a strong climate unit and has implemented 60% of its planned actions. Sindh has also built capacity and has achieved 45% implementation. Balochistan has completed less than 20% of planned actions. Khyber Pakhtunkhwa has also implemented less than 20%. Both provinces face weak institutional capacity and security problems. These gaps place already vulnerable groups in greater danger in marginalized regions (Planning Commission, 2022).

Technological and informational gaps reduce effectiveness. Pakistan does not have advanced climate modeling systems and depends on global institutions for projections. Only 30% of farmers use climate-smart farming methods. Just 15% of industries apply energy-efficient technologies. Weak systems of data collection also restrict evidence-based decisions. The lack of data sharing is most serious at the local level. Local areas face the strongest climate impacts but have the least information support (Global Change Impact Studies Centre, 2022).

Despite these challenges, some sectors show clear progress. Disaster management systems have improved over the past decade, flood related deaths fell by 40% between 2010 and 2022 mainly, due to early warning systems and renewable energy capacity has increased by 5% each year since 2020. These results show that progress is possible with proper resource management. They also show the need for coordination and political stability to build climate resilient system (National Disaster Management Authority, 2023).

Climate Change Adaptation Strategies

Pakistan's high exposure to climate change has made strong adaptation strategies necessary for current and future scenarios. The National Climate Change Adaptation Policy (NCCAP) of 2021 acts as the main framework regarding the climate change strategy in the country. The policy was designed after severe climate threats, including the 2022 floods that displaced 33 million people and caused \$14.9 billion in damages. The NCCAP defines four priority sectors for action which includes agriculture, water, health, and infrastructure. It also sets 42 adaptation actions to be finished by 2030. The policy highlights the role of nature based solutions and community action. It also notes that rural populations face the greatest risks from climate change (Ministry of Climate Change, 2021; World Bank, 2022).

In agriculture, which employs 38.5% of Pakistan's workforce and adds 18.5% to GDP, adaptation aims to protect food security. The Prime Minister's Agriculture Emergency Program has set aside PKR 309 billion (\$1.1 billion) to support climate-resilient methods. These include drought tolerant wheat and flood resistant rice varieties, nearly 500,000 farmers have received training in water efficient irrigation and soil conservation. These steps show progress but remain limited in scope. Only 25% of farmland uses climate adapted practices. Crop yields are still at risk from shifts in rainfall pattern and rising temperatures (Pakistan Economic Survey, 2022-23; FAO, 2022).

Water security is a major adaptation need as Pakistan moves toward water scarcity. Per capita water availability has fallen to 900 cubic meters per year. The National Water Policy (2018) seeks to raise water storage by 40% through new dams and reservoirs. The "Recharge Pakistan" project, funded by a \$66 million Green Climate Fund grant, supports wetland restoration and aquifer recharge. Policies also aim to improve irrigation efficiency, which is only 45% due to old canals and weak water management. Progress has been slow, with only 30% of planned water projects finished on time (Ministry of Water Resources, 2022; GCF, 2021).

Public health adaptation has become urgent due to climate linked disease outbreaks. Dengue cases rose by 50%, and waterborne illnesses spread after the 2022 floods. The National Health Policy (2021) includes climate measures through stronger disease surveillance. A total of 150 monitoring stations now track climate-sensitive diseases across the country. The government has also launched heat action plans in 15 major cities. These plans provide early warnings and cooling centres during extreme heat. Heat related deaths have fallen by 30% in the covered areas. Yet coverage is still limited to cities, and rural populations remain at risk (Ministry of Health, 2022; WHO, 2023).

Infrastructure resilience has become a major priority after climate damage to transport and energy systems. The 2022 floods caused \$3.5 billion in losses to these sectors. The National Infrastructure Policy (2020) sets climate resilience standards for all new projects. These include elevated roads and flood-resistant bridges. The Building Codes of Pakistan now require climate risk checks for new structures. Buildings must be able to withstand stronger winds and flooding. These standards are being tested in 500 schools and 50 healthcare units in high-risk areas, however progress is still slow because of limited funds (Planning Commission, 2022; NDMA, 2023).

Community-based adaptation programs have been started to address local climate risks in rural areas. The Climate Resilient Villages program has reached upto 2,000 communities, it provides household water storage, drought-resistant crops, and community disaster risk plans. These measures have cut climate-driven migration by 40% in participating villages. They have also improved income stability for households. Scaling is still a challenge because only 5% of

vulnerable communities are covered and limited funds and weak logistics are the main barriers (UNDP, 2022; WWF-Pakistan, 2023).

Despite these efforts, major gaps in implementation are still quite observable. Financial support for adaptation is less than 0.5% of GDP, however, the actual need is 2–3% each year. Coordination is weak because 17 federal agencies share overlapping roles. Technical skills at the provincial level are also limited. Monitoring and evaluation systems are not effective and only 20% of adaptation projects have been assessed for impact. These gaps can be reduced with more domestic funding. Stronger institutions and better use of local knowledge are also required (World Bank, 2023; ADB, 2022).

Climate Change Mitigation Strategies

Pakistan has set clear goals to cut greenhouse gas emissions. The Nationally Determined Contribution (NDC) targets a 50% cut in projected emissions by 2030. Out of this target, 15% is unconditional while remaining 35% depends on international support. The National Climate Change Mitigation Policy (NCCMP) gives the framework for this shift. It sets strategies for energy, industry, transport, and forestry sectors. However, Pakistan contributes less than 1% to global emissions and still accepts its duty in climate action. High climate risks also make low carbon growth a top priority (Ministry of Climate Change, 2021; UNFCCC, 2021).

The energy sector makes up 41% of Pakistan's emissions. Mitigation efforts focus on renewable energy and efficient use of resource that are that only increase efficiency but also reduce climate damage. The Alternative and Renewable Energy Policy (AREP) prioritize the use of renewable energy and therefore, sets a target of 60% renewable energy in the power mix by 2030. The policy covers solar, wind, hydropower, and biomass. In 2023, renewable energy was 6% of total power generation and further key projects include the 400 MW wind power corridor in Jhimpir and the 1,000 MW Quaid-e-Azam Solar Park. Energy efficiency is also a priority in this regard the National Energy Efficiency and Conservation Policy aims for a 10% cut in energy use in homes and industries. The policy uses standards and incentives to achieve this goal (National Electric Power Regulatory Authority, 2023; Ministry of Energy, 2022).

The industrial sector produces 25% of emissions. The National Industrial Policy and the Cleaner Production Strategy encourages industries to invest in climate friendly technologies. These policies support energy efficient technology, waste reduction, and compliance with environmental rules. The National Energy Efficiency Award also encourages industries. Winners of this award report energy use that is 20% lower. The cement industry is a major source of emissions. It has installed waste heat recovery systems that cut emissions by 3 million tons each year. Progress still remains slow and only 15% of industries have adopted full energy management systems (Pakistan Industrial Development Corporation, 2022; Ministry of Industries, 2023).

Transportation makes up 15% of Pakistan's emissions. It is managed through the National Transport Policy and the National Electric Vehicle (EV) Policy. The EV Policy sets a goal of 30% electric vehicle sales by 2030. It is backed by tax incentives and new charging stations. Public transport has also helped reduce emissions. The Lahore Metro Bus and Islamabad Green Line carry 500,000 passengers each day. This reduces the need for private vehicles. Major cities are now using Euro 5 standards, which cut sulfur by 90% compared to older fuels (Ministry of Communications, 2022; Punjab Mass Transit Authority, 2023).

Forestry and land use mitigation is driven by the Ten Billion Tree Tsunami Programme (TBTTP). It is one of the largest tree planting projects in the world. Since 2018, the program has restored 1.3

million hectares of forest and degraded land. This has stored about 500 million tons of CO₂ equivalent. Pakistan also takes part in REDD+ programs. The country has received results-based payments from the World Bank for verified emission cuts. Local communities also play a role in forest care. More than 85,000 green jobs have been created. These efforts promote conservation and sustainable land use (Ministry of Climate Change, 2023; World Bank, 2022).

Despite these mitigation efforts, Pakistan still faces significant challenges and hurdles in reducing emissions and unable to transitioning to low-carbon growth. Fossil fuels still dominate the energy mix of the country which create barriers for change. Rapid urban growth and rising industry also add pressure to the cause. These trends make it harder to decarbonize the economy and meet reduction goals. Lack of finance and technological deficiency and policy gaps further block action. These issues reduce the impact of mitigation and slow progress to a low-carbon future (Ministry of Climate Change, 2021).

Comparative Analysis and International Engagements

Pakistan's climate policy aligned with a global system, it was shaped according to international rules and commitments. Being a part of the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement the follow the guidelines set by them. National policies follow the goals set under these agreements. After ratifying the Paris Agreement in 2016, the country set its Nationally Determined Contribution (NDC) in 2021, later NDC sets a target of cutting 50% of projected greenhouse gas emissions by 2030. Out of this, 15% will come from domestic resources. The other 35% will depend on support from global partners. This shows both ambition and the limits created by structural challenges (UNFCCC, 2021; Ministry of Climate Change, 2021).

When compared to regional peers, Pakistan's climate policies show both similarities and unique challenges. Like India and Bangladesh, Pakistan has created national climate policies and added climate concerns into development planning. Pakistan's capacity to implement these policies is weaker. Only 40% of climate projects are completed on time, while Bangladesh completes 65% and India 55%. Pakistan's per capita emissions are low at 1.0 ton CO₂ equivalent. In India, the figure is 2.4 tons and in Bangladesh, it is 0.6 tons. Pakistan faces a higher vulnerability index because of its geography and social conditions (World Bank, 2023; Global Climate Risk Index, 2022).

International climate finance plays an important role in Pakistan's climate actions. Access to these funds is still difficult. Pakistan has received about \$1.2 billion from the Green Climate Fund (GCF) which includes \$66 million for the "Recharge Pakistan" project that supports ecosystem-based adaptation. The World Bank and Asian Development Bank have also given more than \$3 billion in climate finance since 2015. Pakistan still gets only \$5 per person in climate finance. Bangladesh gets \$15 per person and Vietnam gets \$12. This shows clear gaps in access to global funding (Green Climate Fund, 2023; World Bank, 2022).

International cooperation in technological transfer and capacity building has improved Pakistan's climate response. Organizations like the International Centre for Integrated Mountain Development (ICIMOD) and International Renewable Energy Agency (IRENA) also played significant role in providing support to Pakistan cause. These organizations helps in glacier monitoring, flood warning systems and renewable energy development. These efforts are aligned with Pakistan's goal of generating 60% of its energy from renewable sources by 2030. However, the Progress is slow though visible, but access to modern technologies is still limited. Less than

one-fourth of the required technologies are available due to patent restrictions and high financial costs (IRENA, 2022; ICIMOD, 2023).

Pakistan takes part in global climate talks and speaks for the needs of developing countries. The country has strongly supported the Loss and Damage fund created at COP27 to help climate vulnerable nations. Pakistan also leads the Group of 77, using this role to call for more climate finance and technology transfer. Its impact is still limited because of weak diplomatic resources and other foreign policy demands (Ministry of Foreign Affairs, 2022; UNFCCC, 2022).

Monitoring and reporting problems affect Pakistan's capacity to show progress and gain global support. The country has faced difficulty in building a strong Measurement, Reporting, and Verification (MRV) system, and only 30% of climate actions have reliable data. This weakens transparency and accountability, which lowers donor trust and limits access to results based climate finance. Steps to improve this include work on a national MRV framework with help from UNDP. Full implementation is not likely before 2025 (UNDP, 2023; Ministry of Climate Change, 2022).

Regional cooperation is a key part of Pakistan's climate work at the global level. The country joins the South Asia Cooperative Environment Programme (SACEP) and also engages in talks under the Indus Water Treaty that now cover climate concerns. Political tensions have slowed progress on regional efforts to address glacier melt and water management. The idea of regional energy grids and joint early warning systems has not moved forward because of political barriers (SACEP, 2022; Institute of Strategic Studies, 2023).

Conclusion

Pakistan's climate change policy shows a mix of strong planning and serious challenges in practice. The country recognizes the importance of climate change effect and has built a policy framework with the National Climate Change Policy of 2012 and sectoral strategies for energy, agriculture, water, and infrastructure. The Ministry of Climate Change and provincial climate units highlight a stronger role of governance. Pakistan has also engaged at the global level by ratifying the Paris Agreement and submitting Nationally Determined Contributions that aim to cut 50% of projected emissions by 2030.

The success of these policies is limited by major system weaknesses. Financial resources are very low, as climate spending is less than 1% of the national budget, while the estimated need is \$7–14 billion each year. Coordination is also weak because 17 federal agencies overlap and limited provincial capacity. Monitoring and evaluation systems are still not strong, as only 30% of climate actions have reliable data. This gap reduces accountability and makes it difficult to track progress.

The country faces very serious problems in turning adaptation policies into real protection for vulnerable people. Some efforts exist, like the National Climate Change Adaptation Policy and ecosystem-based programs such as Recharge Pakistan and the Ten Billion Tree Tsunami Programme. But weak execution leaves millions still at risk from climate impacts. The 2022 floods which harmed 33 million people and caused \$14.9 billion in damages, show the urgent need for stronger action on resilience measures.

Mitigation efforts show both progress and setbacks. As renewable energy now makes up 6% of the energy mix, not counting large hydro-power. But fossil fuels still supply 60% of electricity production. Emissions from industry and transport keep rising with economic growth and urbanization. Deforestation also continues, even with large tree plantation drives.

Going forward, Pakistan's climate resilience will depend on progress in key areas. These include stronger institutional coordination and better capacity. Climate financing also needs a major increase. Monitoring and evaluation systems must improve with technology transfer and private sector engagement. Policy continuity must be protected during political change. Stronger action both at the provincial and local level is needed, especially in the most vulnerable regions.

With strong effort and support from international partners, Pakistan can address these challenges. Work must follow the principles of equity and inclusion. The country can use its policy frameworks and growing technical skills. The lessons from recent climate disasters also give direction. With these tools Pakistan can move toward a climate-resilient and low carbon future. This will protect both present and future generations.

Future Perspectives and Recommendations

Pakistan is at a turning point in its climate response. The country faces serious risks but also has chances for major change. Its ability to connect climate action after pandemic recovery and economic growth, will shape its strength in the future. Climate impacts are rising continuously, the 2022 floods was the clear example. The need for strong action is greater than ever. The following suggestions give a path for building Pakistan's climate resilience and low-carbon transition (World Bank, 2022; Ministry of Planning, 2023).

- Pakistan needs a central climate authority with clear powers and resources to guide action in all sectors and at all levels of government. The planned Pakistan Climate Change Authority should begin work with a budget of at least 1% of GDP. It also needs strong technical skills to manage the roll-out of climate policies. Provincial climate units must be improved, especially in Balochistan and Khyber Pakhtunkhwa where systems are weakest. Regular meetings between ministries and joint planning sessions should be made a fixed process to reduce gaps and improve policy coordination.
- Pakistan should raise domestic climate finance to at least 2% of GDP each year. This should be matched with stronger access to global climate funds. A clear climate budget tagging system is needed to track spending. The country must also design strong projects that can attract international investors. The Green Climate Fund programme should be widened, and ties with development banks should be deepened to meet the \$7–14 billion yearly finance gap. New tools like green bonds and climate risk insurance should be tested to broaden funding options.
- Pakistan should focus on the growth and use of climate technologies through work with global research bodies and private firms. Climate innovation zones with tax benefits should be created to support clean technology in farming, water use, and renewable energy. The system for intellectual property should be improved to support technology transfer. More funds should be given for research on climate solutions that fit local needs. Digital tools for climate tracking and early warning should be expanded to all risk prone areas.
- Community based adaptation programmes should be expanded to support local people in building climate resilience. At least 30% of adaptation funds should go to projects led by local groups and these efforts must include women, youth, and indigenous people in both planning and action. Local knowledge should be combined with science to create solutions that fit the context. Climate friendly livelihood programmes should be increased to lower risks and promote sustainable growth especially, in areas most affected by climate change.
- Pakistan needs a clear plan for private sector participation in climate action. This should include tax incentives for green investments, carbon pricing tools, and compulsory climate

risk reports from large companies. Public-private partnerships should be created for renewable energy, climate smart farming, and resilient infrastructure. The State Bank of Pakistan should improve green banking rules and encourage climate-friendly investment through special financing terms.

- Pakistan should build a strong MRV (Measurement, Reporting and Verification) system to track climate goals and ensure accountability. The system should use clear indicators and allow regular checks by independent auditors. Climate spending and results should be open to the public. Digital tools for real-time tracking of climate projects should be created. Data collection and analysis capacity should improve at all levels of government. The results of evaluations should guide updates in policy and the use of resources.
- Pakistan should improve regional cooperation on common climate risks, with focus on cross border water use, glacier monitoring, and disaster warning systems. Diplomatic efforts should be increased to protect Pakistan's role in global climate talks. These talks include access to climate funds and transfer of technology. South-South cooperation should grow to share lessons and good practices with other climate vulnerable countries.
- Pakistan should add climate change to school and university courses at all levels and run public campaigns on climate risks and responses. Training programmes for green jobs should be started, and the skills of teachers, journalists, and local leaders on climate issues should be improved. Climate information services should be easy to use and clear for all citizens, with special focus on farmers and coastal groups that face the hardest impacts.

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